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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Herbert Cermak

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PCT No.: PCT/EP01/07150

For: COUNTER TRACK JOINT

Attorney Docket No.: GKNG 1096 PCT

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Signature

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Prior to examination, please amend the application as follows:

**In The Specification:**

On page 5 of the English language translation of the specification, please insert the following heading between the title and the first paragraph of the specification to appear as follows:

COUNTER TRACK JOINT

**Background Of The Invention**

The invention relates to a constant velocity universal ball joint comprising of an outer joint part with outer ball tracks, an inner joint part with inner ball tracks, torque transmitting balls guided in pairs of tracks formed of one outer ball track and one inner ball track, an annular ball cage held between the outer joint part and the inner joint part and having circumferentially distributed cage windows each receiving one of the balls, the ball cage forms an inner face which is internally widened between two end apertures of the ball cage, the inner joint part comprises a greatest outer diameter which is greater than each of the inner diameters of the end apertures of the ball cage.

On page 6 of the English language translation of the specification, please insert the following heading between the first and second full paragraphs of the specification to appear as follows:

In the case of other joints it is possible for the inner joint part to be inserted into the ball cage through an end aperture of same, with intersecting axes, in such a way that one of the webs of the inner joint part engages one of the cage windows from the inside, and the radially opposite web of the inner joint part can subsequently be introduced through the same end aperture into the cage interior. After the inner joint part has reached its central position in the ball cage, the parts are rotated relative to one another in such a way that their axes coincide. This presupposes that the axial extension of at least one of the webs is shorter than the circumferential

extension of the cage windows. Said limitation of the web length restricts the ball guidance in the inner joint part.

**Summary Of The Invention**

With reference to constant velocity fixed ball joints wherein the length of the webs at the inner joint part exceeds the circumferential extension of the cage windows, i.e. in particular with joints with a large number of balls, it is the object of the invention to provide a design which avoids a loss of strength at the cage.

On page 8 of the English language translation of the specification, please amend the first full paragraph to appear as follows:

According to a special embodiment it is proposed that a longitudinally extending deepened groove has been worked into the track base of at least one inner ball track of the inner joint part. Furthermore, it is proposed that a centrally circumferentially extending deepened groove has been worked into the inner face of the ball cage. Furthermore, it is conceivable that, at least in a widened end portion of an inner ball track of the inner joint part, there has been worked in a notch which extends centrally relative to the longitudinal extension of the track. With the help of said measures the extent of ovalisation of the ball cage required for mounting the cage can be reduced in that there is achieved a deeper engagement between the inner edge of the end aperture of the cage and the inner ball track of the inner joint part.

On page 8 of the English language translation of the specification, please insert the following heading between the second and third full paragraphs of the specification to appear as follows:

The solution in accordance with the invention is particularly suitable for joints with counter tracks wherein pairs of tracks of first outer ball tracks and of first inner ball tracks open in a first axial direction and wherein pairs of tracks of second outer ball track and of second inner ball tracks open in the second opposed axial direction. These joints will primarily be fixed joints wherein inner annular faces of the inner face of the ball cage are in a centring contact with outer faces of the inner joint part.

**Brief Description Of The Drawings**

Preferred embodiments of the invention are illustrated in the Figures and will be described below in greater detail with reference to the drawings wherein

On page 10 of the English language translation of the specification, please insert the following heading between the second and third paragraphs of the specification to appear as follows:

Figure 7 For the most unfavourable assembly condition regarding the assembly of the ball cage and inner joint part:

- a) an axial view of the ovalised ball cage
- b) an axial view of the inner joint part and a longitudinal section through the ball cage in the characteristic assembly stage.

**Detailed Description Of The Invention**

Figure 1 is a longitudinal section through a constant velocity fixed ball joint of the type of a counter track joint; it shows an outer joint part 11, an inner joint part 12, balls 13 and a ball cage 17 in the form of different individual components. In the upper half of the Figure there is shown a pair of tracks consisting of a first outer ball track 15<sub>1</sub> in the outer joint part and a first inner ball track 16<sub>1</sub> in the inner joint part which forms an opening angle which opens towards the right. In the lower half of the Figure it is possible to see a pair of tracks consisting of a second outer ball track 15<sub>2</sub> in the outer joint part and a second inner ball track 16<sub>2</sub> in the inner joint part which forms an opening angle which opens towards the left. A joint with this kind of ball track formation is called a counter track joint. The two types of pairs of tracks - if viewed across the circumference - normally alternate with one another, i.e. as a rule, such joints are provided with an even number of balls. The balls 13 are received by cage windows 18 in the ball cage 17 which holds all the balls in such a way that their centres are located in a common plane. The inner ball tracks 16 comprise widening end portions 19, 20 which cannot have ball guiding functions. Further details will be explained with reference to the following Figures 2 and 3.

In The Claims:

Please cancel claims 1-8.

Please add new claims 9-28 to read as follows:

9. (New) A constant velocity universal ball joint comprising:

an outer joint part (11) with outer ball tracks (15), an inner joint part (12) with inner ball tracks (16), torque transmitting balls (13) guided in pairs of tracks comprising one of said outer ball tracks (15) and one of said inner ball tracks (16), and an annular ball cage (17) held between the outer joint part (11) and the inner joint part (12) and having circumferentially distributed cage windows (18) each receiving one of the balls (13), the ball cage (17) comprising an inner face (23) which is internally widened between two end apertures (21, 22) of the ball cage, the end apertures (21, 22) defining an inner diameter ( $d_1$ ), the inner joint part (12) defining an outer diameter ( $d_2$ ) which is greater than the inner diameter ( $d_1$ ) of the end apertures (21, 22) of the ball cage, and

wherein adjoining inner ball tracks (16) of the inner joint part (12) form webs (27) whose axial length ( $x$ ) is greater than a circumferential extension ( $y$ ) of the cage windows (18) of the ball cage (17), and

wherein the ball cage (17) is elastically ovalisable such that, when respective axes of the ball cage (17) and of the inner joint part (12) intersect one another approximately

perpendicularly upon contact between a web (27<sub>1</sub>) of the inner joint part (12) and the inner face (23) of the ball cage (17), an opposed web (27<sub>2</sub>) of the inner joint part (12) is able to pass through an end aperture (21, 22).

10. (New) A joint according to claim 9, wherein the ball cage (17) is elastically ovalised such that, when respective axes of the ball cage (17) and of the inner joint part (12) intersect one another approximately perpendicularly, the inner joint part (12) is able, by way of a smallest side projection diameter ( $d_5$ ), to pass through an end aperture (21, 22) of the ball cage.

11. (New) A joint according to claim 9, wherein the ball cage (17) is elastically ovalised such that, when respective axes of the ball cage (17) and of the inner joint part (12) intersect one another approximately perpendicularly, the inner joint part (12) is able, by way of the inner diameter ( $d_1$ ), to pass through the end aperture (21, 22) of the ball cage.

12. (New) A joint according to claim 9 comprising a longitudinally extending deepened groove (29) in a track base of at least one inner ball track (16) of the inner joint part (12).

13. (New) A joint according to claim 10 comprising a longitudinally extending deepened groove (29) in a track

base of at least one inner ball track (16) of the inner joint part (12).

14. (New) A joint according to claim 11 comprising a longitudinally extending deepened groove (29) in a track base of at least one inner ball track (16) of the inner joint part (12).

15. (New) A joint according to claim 9 comprising a centrally circumferentially extending deepened groove (24) in the inner face (23) of the ball cage (17).

16. (New) A joint according to claim 10 comprising a centrally circumferentially extending deepened groove (24) in the inner face (23) of the ball cage (17).

17. (New) A joint according to claim 11 comprising a centrally circumferentially extending deepened groove (24) in the inner face (23) of the ball cage (17).

18. (New) A joint according to claim 12 comprising a centrally circumferentially extending deepened groove (24) in the inner face (23) of the ball cage (17).

19. (New) A joint according to claim 9 comprising a notch in a widened end portion (19, 20) of an inner ball track (16) of the inner joint part, said notch extending centrally relative to a longitudinal extension of the track.

20. (New) A joint according to claim 12 comprising a notch in a widened end portion (19, 20) of an inner ball track (16) of the inner joint part, said notch extending centrally relative to a longitudinal extension of the track.

21. (New) A joint according to claim 15 comprising a notch in a widened end portion (19, 20) of an inner ball track (16) of the inner joint part, said notch extending centrally relative to a longitudinal extension of the track.

22. (New) A joint according to claim 18 comprising a notch in a widened end portion (19, 20) of an inner ball track (16) of the inner joint part, said notch extending centrally relative to a longitudinal extension of the track.

23. (New) A joint according to claim 9 wherein the joint is a counter track joint wherein pairs of tracks of first outer ball tracks (15<sub>1</sub>) and of first inner ball tracks (16<sub>1</sub>) open in a first axial direction, and wherein pairs of tracks of second outer ball tracks (15<sub>2</sub>) and of second inner ball tracks (16<sub>2</sub>) open in the second axial direction.

24. (New) A joint according to claim 12 wherein the joint is a counter track joint wherein pairs of tracks of first outer ball tracks (15<sub>1</sub>) and of first inner ball tracks (16<sub>1</sub>) open in a first axial direction, and wherein pairs of tracks of second outer ball tracks (15<sub>2</sub>) and of second inner ball tracks (16<sub>2</sub>) open in the second axial direction.

25. (New) A joint according to claim 15 wherein the joint is a counter track joint wherein pairs of tracks of first outer ball tracks (15<sub>1</sub>) and of first inner ball tracks (16<sub>1</sub>) open in a first axial direction, and wherein pairs of tracks of second outer ball tracks (15<sub>2</sub>) and of second inner ball tracks (16<sub>2</sub>) open in the second axial direction.

26. (New) A joint according to claim 18 wherein the joint is a counter track joint wherein pairs of tracks of first outer ball tracks (15<sub>1</sub>) and of first inner ball tracks (16<sub>1</sub>) open in a first axial direction, and wherein pairs of tracks of second outer ball tracks (15<sub>2</sub>) and of second inner ball tracks (16<sub>2</sub>) open in the second axial direction.

27. (New) A joint according to claim 9 wherein the joint is a fixed joint, wherein inner annular faces of the inner face (23) of the ball cage (17) are in centering contact with outer faces (28) of the inner joint part (12).

28. (New) A joint according to claim 18 wherein the joint is a fixed joint, wherein inner annular faces of the inner face (23) of the ball cage (17) are in centering contact with outer faces (28) of the inner joint part (12).

**REMARKS**

The PCT application contains 8 claims. Claims 1-8 have been amended and new claims 9-20 have been added to conform to U.S. practice. The specification has also been amended to conform to U.S. practice. No new matter has been added. Examination of the same is now requested.

Respectfully Submitted,

**ARTZ & ARTZ, P.C.**



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Dated: March 4, 2002

## VERSION WITH MARKINGS TO SHOWING CHANGES MADE

### In The Specification:

On page 5 of the English language translation of the specification, please insert the following heading between the title and the first paragraph of the specification to appear as follows:

## COUNTER TRACK JOINT

## **[Description] Background Of The Invention**

The invention relates to a constant velocity universal ball joint comprising of an outer joint part with outer ball tracks, an inner joint part with inner ball tracks, torque transmitting balls guided in pairs of tracks formed of one outer ball track and one inner ball track, an annular ball cage held between the outer joint part and the inner joint part and having circumferentially distributed cage windows each receiving one of the balls, the ball cage forms an inner face which is internally widened between two end apertures of the ball cage, the inner joint part comprises a greatest outer diameter which is greater than each of the inner diameters of the end apertures of the ball cage.

On page 6 of the English language translation of the specification, please insert the following heading between the first and second full paragraphs of the specification to appear as follows:

In the case of other joints it is possible for the inner joint part to be inserted into the ball cage through an end aperture of same, with intersecting axes, in such a way that one of the

webs of the inner joint part engages one of the cage windows from the inside, and the radially opposite web of the inner joint part can subsequently be introduced through the same end aperture into the cage interior. After the inner joint part has reached its central position in the ball cage, the parts are rotated relative to one another in such a way that their axes coincide. This presupposes that the axial extension of at least one of the webs is shorter than the circumferential extension of the cage windows. Said limitation of the web length restricts the ball guidance in the inner joint part.

**Summary Of The Invention**

With reference to constant velocity fixed ball joints wherein the length of the webs at the inner joint part exceeds the circumferential extension of the cage windows, i.e. in particular with joints with a large number of balls, it is the object of the invention to provide a design which avoids a loss of strength at the cage.

On page 8 of the English language translation of the specification, please amend the first full paragraph to appear as follows:

According to a special embodiment it is proposed that a longitudinally extending deepened groove [as] has been worked into the track base of at least one inner ball track of the inner joint part. Furthermore, it is proposed that a centrally circumferentially extending deepened groove has been worked into the inner face of the ball cage. Furthermore, it is conceivable that, at least in a widened end portion of an inner ball track of the inner joint part, there has

been worked in a notch which extends centrally relative to the longitudinal extension of the track. With the help of said measures the extent of ovalisation of the ball cage required for mounting the cage can be reduced in that there is achieved a deeper engagement between the inner edge of the end aperture of the cage and the inner ball track of the inner joint part.

On page 8 of the English language translation of the specification, please insert the following heading between the second and third full paragraphs of the specification to appear as follows:

The solution in accordance with the invention is particularly suitable for joints with counter tracks wherein pairs of tracks of first outer ball tracks and of first inner ball tracks open in a first axial direction and wherein pairs of tracks of second outer ball track and of second inner ball tracks open in the second opposed axial direction. These joints will primarily be fixed joints wherein inner annular faces of the inner face of the ball cage are in a centring contact with outer faces of the inner joint part.

**Brief Description Of The Drawings**

Preferred embodiments of the invention are illustrated in the Figures and will be described below in greater detail with reference to the drawings wherein

On page 10 of the English language translation of the specification, please insert the following heading between the second and third paragraphs of the specification to appear as follows:

Figure 7 For the most unfavourable assembly condition regarding the assembly of the ball cage and inner joint part:

- c) an axial view of the ovalised ball cage
- d) an axial view of the inner joint part and a longitudinal section through the ball cage in the characteristic assembly stage.

**Detailed Description Of The Invention**

Figure 1 is a longitudinal section through a constant velocity fixed ball joint of the type of a counter track joint; it shows an outer joint part 11, an inner joint part 12, balls 13 and a ball cage 17 in the form of different individual components. In the upper half of the Figure there is shown a pair of tracks consisting of a first outer ball track 15<sub>1</sub> in the outer joint part and a first inner ball track 16<sub>1</sub> in the inner joint part which forms an opening angle which opens towards the right. In the lower half of the Figure it is possible to see a pair of tracks consisting of a second outer ball track 15<sub>2</sub> in the outer joint part and a second inner ball track 16<sub>2</sub> in the inner joint part which forms an opening angle which opens towards the left. A joint with this kind of ball track formation is called a counter track joint. The two types of pairs of tracks – if viewed across the circumference – normally alternate with one another, i.e. as a rule, such joints are provided with an even number of balls. The balls 13 are received by cage windows 18 in the ball cage 17 which holds all the balls in such a way that their centres are located in a common plane. The inner ball tracks 16 comprise widening end portions 19, 20 which cannot have ball guiding functions. Further details

will be explained with reference to the following Figures 2 and 3.

**In The Claims:**

Please cancel claims 1-8.

Please add new claims 9-28 to read as follows:

9. (New) A constant velocity universal ball joint comprising:  
an outer joint part (11) with outer ball tracks (15), an inner joint part (12) with inner ball tracks (16), torque transmitting balls (13) guided in pairs of tracks comprising one of said outer ball tracks (15) and one of said inner ball tracks (16), and an annular ball cage (17) held between the outer joint part (11) and the inner joint part (12) and having circumferentially distributed cage windows (18) each receiving one of the balls (13), the ball cage (17) comprising an inner face (23) which is internally widened between two end apertures (21, 22) of the ball cage, the end apertures (21, 22) defining an inner diameter ( $d_1$ ), the inner joint part (12) defining an outer diameter ( $d_2$ ) which is greater than the inner diameter ( $d_1$ ) of the end apertures (21, 22) of the ball cage, and  
wherein adjoining inner ball tracks (16) of the inner joint part (12) form webs (27) whose axial length (x) is greater than a circumferential extension (y) of the cage windows (18) of the ball cage (17), and

wherein the ball cage (17) is elastically ovalisable such that, when respective axes of the ball cage (17) and of the inner joint part (12) intersect one another approximately perpendicularly upon contact between a web (27<sub>1</sub>) of the inner joint part (12) and the inner face (23) of the ball cage (17), an opposed web (27<sub>2</sub>) of the inner joint part (12) is able to pass through an end aperture (21, 22).

10. (New) A joint according to claim 9, wherein the ball cage (17) is elastically ovalised such that, when respective axes of the ball cage (17) and of the inner joint part (12) intersect one another approximately perpendicularly, the inner joint part (12) is able, by way of a smallest side projection diameter (d<sub>5</sub>), to pass through an end aperture (21, 22) of the ball cage.

11. (New) A joint according to claim 9, wherein the ball cage (17) is elastically ovalised such that, when respective axes of the ball cage (17) and of the inner joint part (12) intersect one another approximately perpendicularly, the inner joint part (12) is able, by way of the inner diameter (d<sub>1</sub>), to pass through the end aperture (21, 22) of the ball cage.

12. (New) A joint according to claim 9 comprising a longitudinally extending deepened groove (29) in a track

**base of at least one inner ball track (16) of the inner joint part (12).**

13. (New) **A joint according to claim 10 comprising a longitudinally extending deepened groove (29) in a track base of at least one inner ball track (16) of the inner joint part (12).**

14. (New) **A joint according to claim 11 comprising a longitudinally extending deepened groove (29) in a track base of at least one inner ball track (16) of the inner joint part (12).**

15. (New) **A joint according to claim 9 comprising a centrally circumferentially extending deepened groove (24) in the inner face (23) of the ball cage (17).**

16. (New) **A joint according to claim 10 comprising a centrally circumferentially extending deepened groove (24) in the inner face (23) of the ball cage (17).**

17. (New) **A joint according to claim 11 comprising a centrally circumferentially extending deepened groove (24) in the inner face (23) of the ball cage (17).**

18. (New) A joint according to claim 12 comprising a centrally circumferentially extending deepened groove (24) in the inner face (23) of the ball cage (17).

19. (New) A joint according to claim 9 comprising a notch in a widened end portion (19, 20) of an inner ball track (16) of the inner joint part, said notch extending centrally relative to a longitudinal extension of the track.

20. (New) A joint according to claim 12 comprising a notch in a widened end portion (19, 20) of an inner ball track (16) of the inner joint part, said notch extending centrally relative to a longitudinal extension of the track.

21. (New) A joint according to claim 15 comprising a notch in a widened end portion (19, 20) of an inner ball track (16) of the inner joint part, said notch extending centrally relative to a longitudinal extension of the track.

22. (New) A joint according to claim 18 comprising a notch in a widened end portion (19, 20) of an inner ball track (16) of the inner joint part, said notch extending centrally relative to a longitudinal extension of the track.

23. (New) A joint according to claim 9 wherein the joint is a counter track joint wherein pairs of tracks of first outer ball tracks (15<sub>1</sub>) and of first inner ball tracks (16<sub>1</sub>) open in a first axial direction, and wherein pairs of tracks of second outer ball tracks (15<sub>2</sub>) and of second inner ball tracks (16<sub>2</sub>) open in the second axial direction.

24. (New) A joint according to claim 12 wherein the joint is a counter track joint wherein pairs of tracks of first outer ball tracks (15<sub>1</sub>) and of first inner ball tracks (16<sub>1</sub>) open in a first axial direction, and wherein pairs of tracks of second outer ball tracks (15<sub>2</sub>) and of second inner ball tracks (16<sub>2</sub>) open in the second axial direction.

25. (New) A joint according to claim 15 wherein the joint is a counter track joint wherein pairs of tracks of first outer ball tracks (15<sub>1</sub>) and of first inner ball tracks (16<sub>1</sub>) open in a first axial direction, and wherein pairs of tracks of second outer ball tracks (15<sub>2</sub>) and of second inner ball tracks (16<sub>2</sub>) open in the second axial direction.

26. (New) A joint according to claim 18 wherein the joint is a counter track joint wherein pairs of tracks of first outer ball tracks (15<sub>1</sub>) and of first inner ball tracks (16<sub>1</sub>) open in a first axial direction, and wherein pairs of tracks of second outer ball tracks (15<sub>2</sub>) and of second inner ball tracks (16<sub>2</sub>) open in the second axial direction.

27. (New) A joint according to claim 9 wherein the joint is a fixed joint, wherein inner annular faces of the inner face (23) of the ball cage (17) are in centering contact with outer faces (28) of the inner joint part (12).

28. (New) A joint according to claim 18 wherein the joint is a fixed joint, wherein inner annular faces of the inner face (23) of the ball cage (17) are in centering contact with outer faces (28) of the inner joint part (12).